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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

# (54) Apparatus for Transloading Load Units Between Railway Vehicles and Road Vehicles and Vice Versa

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## ABSTRACT OF THE DISCLOSURE

An apparatus for transloading of load units between rail vehicles and road vehicles utilizes a railway roadway and a road vehicle roadway which are parallel to one another and a transport stretch in the form of a conveyor on which the load units can travel as well as parallel to the two roadways. A transloading unit, for example, a portal load handling unit can also travel along a path parallel to these roadways so that the load unit can be picked up from the railroad vehicle while the latter and the transloading unit are moving together, i.e. at zero relative speed and can set down the load on the transport stretch where the load continues to move with the transloading unit. Conversely, a load traveling along the transport stretch can be picked up by the transfer unit which is likewise traveling along that stretch and deposit it upon a railway vehicle without bringing the latter to standstill and again at zero relative speed.

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# *APPARATUS FOR TRANSLOADING LOAD UNITS BETWEEN RAILWAY VEHICLES AND ROAD VEHICLES AND VICE VERSA*

## SPECIFICATION

### FIELD OF THE INVENTION

My present invention relates to an apparatus for the transloading of load units, like containers, trailers for semitrailers or trailer-tractor combinations, and the like, between rail vehicles and road vehicles or between road vehicles and rail vehicles utilizing a traveling transloading device which is displaceable along the rail line or the roadway.

### BACKGROUND OF THE INVENTION

For transloading of load units between rail and road vehicles or between road and rail vehicles, it has been necessary heretofore not only to bring the road vehicle to standstill but also to bring the rail vehicle or train to standstill so that the transloading device can engage a load unit on the vehicle or deposit a load vehicle on the vehicle. As a consequence, long standstill periods characterized the loading and unloading of trains which significantly delay the operation of nontransport systems involving railway vehicles. While long layover times often characterize truck transport, the fact that a truck is at standstill for a long period of time may not be as detrimental since a truck at standstill does not block a line which might otherwise be used for travel as in the case of railway vehicles.

## OBJECTS OF THE INVENTION

It is, therefore, the principal object of the present invention to provide an improved transloading apparatus for the purposes described which can effect operations in a shorter period of time than has hitherto been the case.

Another object of the invention is to provide an improved system for the transloading of load units to and from rail vehicles which will reduce the standstill time of such vehicles and hence obstruction of a railway track.

Still another object of the invention is to provide an improved system for the handling of load units, particularly containers and trailer units, which simplifies loading and unloading.

## SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the invention, by providing parallel to the railway track or roadway and to the road-vehicle roadway, a transport stretch for receiving load units unloaded from the rail vehicle or to be loaded onto the rail vehicle. This enables unloading or loading of the rail vehicle with the traveling load shifter while the rail vehicle is in motion. In the case of the loading of a rail vehicle, the load unit prior to the arrival of the train is removed from the road vehicle via the traveling load shifter and deposited upon the transport stretch. From the latter, while the load unit is

displaced along the transport stretch and while the rail vehicle is traveling therealong with reduced speed, the traveling load shifter can pick up the load unit and deposit it upon the rail vehicle with zero relative speed in the travel direction between the load unit and the car of the train upon which the latter is deposited.

In the case of unloading of load units from the vehicle, the load units are engaged by the traveling load shifter while the train is in motion and deposited upon the transport stretch so as to move along the latter parallel to the train, the load unit being later loaded onto the railway vehicle from the transport stretch.

According to a feature of the invention, the transport stretch is a roller conveyor, the rolls of which are individually provided with respective drives or are driven in groups by suitable drives. This allows the speed of the transport stretch to be matched to that of the traveling load shifter and the railway vehicle and can also ensure that the angular velocity of the rolls can be equal and controlled so that the rolls can be accelerated to the speed necessary to receive a load unit or deliver a load unit and can be brought to standstill where desired, thereby ensuring that transfer of load units from and to the transport stretch by means of the traveling load shifter takes place at zero relative speed of the load unit and the transport stretch in the direction of travel.

According to a feature of the invention on the side of the road-vehicle roadway opposite that along which the transport

stretch is provided or between the road vehicle roadway and the transport stretch, a storage area or store is located on which load units can be stored. A conveyor system operating at a right angle or perpendicular to the roadways and transport stretch can carry load units to and from the store. The transverse conveyor thus can move load units from the roadway vehicles onto the storage site for later delivery to the transport stretch or from the transport stretch to the storage site for later delivery to road vehicles.

In a preferred embodiment of the invention between two stores, an alley or gap is provided and the transverse conveyor is provided in this gap at a right angle to the rail vehicle and road vehicle roadways.

While it has been proposed heretofore to provide a system for the loading or unloading of rail vehicles while they travel at an average speed of about 0.4 m/s through the system, the so-called rendezvous technique, the pick-up of the load units and their depositing poses difficulties because of the need to accelerate masses of up to 60 metric tons or brake such masses in effecting the transfer.

With the system of the invention, the transfer is effected between load units and rail vehicles at zero relative speed in the travel direction of the railroad car. The vehicle preferably is displaced at a speed of about 0.1 m/s through the loading zone. By comparison with the earlier system, therefore, the invention has the advantages of no need to accelerate suspended loads, short travel times of the traveling load shifter

parallel to the rail line since loading and unloading are speeded up, and minimal requirements with respect to acceleration or breaking of the load units.

The unloading of units from a rail vehicle is simplified even further when these load units are, as is customary, brought to standstill on the transport stretch.

After positioning of the load unit on the rolls of the roller conveyor, the latter can accelerate the load unit to the requisite speed before the transverse conveyor is braked and the load is transferred thereto.

The rail vehicle can move through the transfer region continuously or the system can be operated in a cadence whereby the railroad vehicle is brought to standstill, then accelerated and then braked, as long as, in accordance with the invention, the transfer of the load unit to and from the rail vehicle is effected while the latter and the traveling load shifter are in motion.

According to another feature of the invention, the transport stretch is made up of carriages which are also the load-carrying elements of the transverse conveyor and at the junction between the transport stretch and the transverse conveyor, a transfer unit is provided for transferring the carriages between the transport stretch and the transverse conveyor.

In this construction, the unloading of load units from a rail vehicle and the passage of the load units onto the transverse conveyor can be carried out especially simply.

The transverse conveyor can be so constructed that the vehicle roadway passes over the transverse conveyor and the carriages thereof. This is also the case when the road vehicle roadway is provided between the transport stretch and store.

It has been found to be an especially effective construction, according to the invention, to provide the carriages with four wheels oriented for movement of the carriages along the transverse conveyor and another set of four wheels oriented for movement of the carriages along the transport stretch. One wheel of each set at least can be provided with the drive. The latter can be formed by a single motor and two shafts with a transmission between the shafts. This arrangement simplifies speed and direction control of the carriage.

The transfer unit at the junction of the transverse conveyor and the transport stretch can have two pairs of rail sections oriented orthogonally to one another which can be selectively raised into position or lowered out of engagement with the carriage.

More specifically, an apparatus for transloading load units can comprise:

a railway roadway and a railway vehicle traveling along the railway roadway;

a road-vehicle roadway parallel to the railway roadway, and at least one road vehicle adapted to travel along the road-vehicle roadway;

a transport stretch extending parallel to the roadways and provided with means for displacing a load unit along the

transport stretch parallel to the roadways and vehicles traveling thereon; and

a traveling load shifter shiftable along the roadways and engageable with a load unit on a vehicle traveling on one of the roadways while the vehicle is in motion on the one of the roadways for transferring an engaged load unit from the vehicle in motion on the one of the roadways to the transport stretch, and for engagement with a load unit while it is being displaced along the transport stretch for transferring same to a vehicle moving along one of the roadways.

## BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a highly diagrammatic plan view of transloading apparatus according to the invention;

FIG. 2 is a highly diagrammatic plan view drawn to a smaller scale than FIG. 1 of another transloading apparatus rotated through 90° from the view of FIG. 1;

FIG. 3 is a view similar to FIG. 2 but illustrating another embodiment of the invention;

FIG. 4 is a bottom view of a conveyor carriage according to the invention drawn to a much larger scale than FIGS. 1-3;

FIG. 5 is a longitudinal cross sectional view through the transverse conveyor showing a transfer unit at the junction with the transport stretch;

FIG. 6 is a section through the conveyor of FIG. 5; and

FIG. 7 is a diagrammatic elevational view illustrating the traveling load shifter of the invention in the form of a portal crane.

## SPECIFIC DESCRIPTION

FIG. 1 shows an embodiment of the invention in which a railway track 1 is provided parallel to a roadway 2 for road vehicle 6, for example, a truck drawing a trailer which can be a load unit or on which a container can be placed, the truck 6 being shown to have a tractor 6a towing the trailer 6b. The railway track 1 supports a train of rail cars which can be flatbed cars adapted to receive load units in the form of the road vehicle trailers mentioned previously and/or containers as represented at 5. Between the railway track 1 and the roadway 2 is a roller conveyer 3 forming a transport stretch along which the load units 5 can be driven, e.g. by motorized drives for the rollers 9 of the roller conveyor 3. The containers 5 can be unloaded from the railway cars 4 onto the roller conveyor 3 or loaded from the roller conveyor 3' to the railway cars 4 while the cars are in motion.

The traveling load shifter comprises a portal crane 7 which spans the set of parallel roadways and the transport stretch and is displaceable on rails 8 parallel to them. In the

case of an unloading of the railway cars 4 with the load units 5, the load units 5 before the arrival of the train of railway cars are transferred from the road vehicles 6 to the roller conveyor 3 and are then loaded from the latter onto the railway car. In the case of an unloading, the load units 5 are removed from the railway cars 4 and placed on the roller conveyor 3 from which at a later time they can be transferred to the road vehicle.

In both cases the transloading is effected by means of the traveling load shifter 7 which is displaced parallel to the railway track and the roadway 2 on rails 8. The rollers 9 may be individually driven, e.g. by motors 3a or driven in groups as shown via motor 3b and an appropriate transmission system represented by the broken lines 2c in FIG. 1.

As can be seen from FIG. 7, the traveling load shifter 7 can comprise a portal frame 7a riding via wheels 7b driven by motors 7c on tracks 8 parallel to the railway track 1 and the roadway 2 and, of course, parallel to the roller conveyor 3 as previously mentioned.

A pair of carriages 7d and 7e can ride by rollers 7el on the lower flange 7f of a beam 7g forming the upper member of the portal frame and may carry transverse beams 7h which are perpendicular to the plane of the paper in FIG. 1.

At the ends of these transverse beams, downwardly extending columns 7i are provided and carry vertically-moving lifting members 7j which have claws or other formations engageable in suitable recesses or pockets in the container 5 so as to lift them from the bottom along the columns 7I.

The carriages 7d and 7e can be displaced independently to bring the columns against the container and then can be moved jointly, once the container 5 has been lifted to carry the container form the transport stretch 3 to the rail car 4 on the track 1. The portal frame shown in FIG. 7 can travel parallel to the rail line and roadway at the speed of the railway train and the speed at which the load unit is displaced on the roller conveyor 3.

FIG. 2 shows an embodiment which is generally similar to that of FIG. 1 in that a railway track 1 is provided parallel to a road vehicle roadway 2 and a roller conveyer 3 is provided between the road-vehicle roadway and the railway track.

The portal crane 8 forming the load shifters are here also provided, traveling on tracks 8.

In this embodiment, in addition, there are three storage areas 10.1, 10.2 and 10.3 for the load units 5. The three storage areas 10.1, 10.2, 10.3 or a "stores" are separated by two alleys or gaps in which respective transverse conveyors 11 and 12 are provided.

The transloading apparatus has a gate 13 for the rail and road vehicles 4 and 6 and a gate 14 for the rail vehicles 4. The term "gate" is used here to refer to a detection and registration station at which the vehicles passing the gate are detected for subsequent positioning and direction and the positions of the vehicles and their status can be registered so that destinations within the apparatus can be established and

completion of loading, state of loading, etc. can be registered and acknowledged.

From the gate 13 to shortly before the store 10.1, there extends a preliminary zone 15 (see the top of FIG. 2) to which a first transloading region/rail 16 is connected. The transloading region/rail 16 extends along the store 10.1 and the transverse conveyor 11. It is followed by a transfer region/rail vehicle 17, a further transloading region/rail 18 (which extends along the transverse conveyor 12 and the store 10.3) and an after zone 19 running to the gate 14.

On the opposite side of the transloading apparatus, shown at the bottom part of FIG. 2, there is provided a further street vehicle roadway 2'. This street vehicle roadway 2' forms a transloading region/road 20 which extends along the three stores 10.1, 10.2, 10.3 and the transverse conveyors 11 and 12 between them.

For the transloading zone/rail 16 and the transloading zone/rail 18, respective transloading units 7 (FIG. 7) are provided. In the transloading zone /road 20, for loading and unloading the road vehicles or trucks 6, two further transloading units 21 are provided in the regions of the transverse conveyors 11 and 12. These transloading units 21 can be portal cranes of the type shown in FIG. 1, each, however, may be movable on rails as described for the unit 7 or can be stationary as may be desired.

The transverse conveyors 11 and 12 can have transverse conveyor carriages 11 with respective drives displaceable in two

planes and in both directions, as will be described in connection with FIGS. 4-6.

The embodiment of FIG. 3 differs from that of FIG. 2 in that, while the transport stretch 3 in FIG. 2 is formed by a roller conveyor, in FIG. 3, this transport stretch is formed by a succession of the carriages 22 which can travel parallel to the track 1 and the roadway 2. At the crossing between the transport stretch and each transverse conveyor 11, 12, a transfer device 23 is provided which can place a carriage 22 from the transverse conveyor onto the transport stretch or return a carriage 22 from the transport stretch to the transverse conveyor, with or without a respective load unit thereon.

FIG. 4 shows the underside of one such transverse conveyor carriage 22 which can be seen to have a first set of four wheels aligned for movement of the carriage 22 in the direction of arrow 25, i.e. along the transverse conveyors 11, 12 (see FIGS. 2 and 3).

The transverse conveyor has another set of four wheels 26 for movement of the transverse conveyor carriage 22 in the direction of arrow 27, i.e. along the transport stretch (FIG. 3). Two of the wheels of each set of wheels 24 and 26 are driven by a drive which comprises a motor 28, the drive shafts 29 and 30 and a transmission coupling the drive shafts 29 and 30 with one another and represented at 31.

As has been represented by broken lines in FIG. 4, the wheels 24 of the transverse conveyor carriage 22 rode on rails 33 while the wheels 26 are adapted to ride on rails 34. In the

region of the transfer unit 23 (compare FIGS. 3), the rails 33 and 34 have respective segments 33A and 34A which are raisable and lowerable. When the transverse conveyor carriage 22 is fed onto the transverse unit 23, for example via the rails 33, section 33A is aligned therewith while section 34A has been lowered, the latter section lying at a right angle to section 33A. When the carriage 22 comes to standstill, section 34A is raised and section 33A lowered so that travel can continue along the rails 34. Transfer from the transport stretch to the conveyor 11 or 12 is effected in the opposite sequence. The sections 34A and 33A terminate so that the rails do not overlap, thereby allowing one of the rail sections to be lowered and the other raised.

FIG. 5 shows a transverse conveyor 11 with the associated transfer unit 23 which has a hydraulic lifting system 32 allowing the carriage 22 to be lowered after removal of a load unit therefrom onto the lower stretch of the conveyor. The upper and lower stretches are also visible in FIG. 6. In FIGS. 5 and 6 the wheels of the carriage 22 have been omitted to simplify the illustrations.

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I CLAIM:

1. An apparatus for transloading load units, comprising:

a railway roadway and a railway vehicle traveling along said railway roadway;

a road-vehicle roadway parallel to said railway roadway, and at least one road vehicle adapted to travel along said road-vehicle roadway;

a transport stretch extending parallel to said roadways and provided with means for displacing a load unit along said transport stretch parallel to said roadways and vehicles traveling thereon; and

a traveling load shifter shiftable along said roadways and engageable with a load unit on a vehicle traveling on one of said roadways while said vehicle is in motion on said one of said roadways for transferring an engaged load unit from the vehicle in motion on said one of said roadways to said transport stretch, and for engagement with a load unit while it is being displaced along said transport stretch for transferring same to a vehicle moving along one of said roadways.

2. The apparatus defined in claim 1 wherein said transport stretch is a roller conveyor.

3. The apparatus defined in claim 2 wherein said roller conveyor has respective drives for individual rollers of said conveyor.

4. The apparatus defined in claim 2 wherein said roller conveyor has respective drives for groups of rollers of said conveyor.

5. The apparatus defined in claim 2 wherein said roller conveyor has a plurality of individually controllable drives for rollers of said conveyor.

6. The apparatus defined in claim 1, further comprising means forming a store for said load units on a side of said road-vehicle roadway opposite that along which said transport stretch extends, and means at said store for shifting said load units at a right angle to said roadways and said stretch.

7. The apparatus defined in claim 1, further comprising means forming a store for said load units between said road-vehicle roadway and said transport stretch, and means at said store for shifting said load units at a right angle to said roadways and said stretch.

8. The apparatus defined in claim 1, further comprising means forming a plurality of stores for said load units separated by gaps extending transversely to said roadways and said transport stretch, and transverse conveyor means in said gaps for shifting said load units at a right angle to said roadways and said stretch.

9. The apparatus defined in claim 8 wherein said transverse conveyor means comprises a multiplicity of carriages and means for shifting said carriages perpendicular to said transport stretch, said transport stretch comprising a plurality of said carriages shiftable along said roadways, said apparatus further comprising transfer means between said transport stretch and said transverse conveyor means for transferring said carriages between said transverse conveyor means and said transport stretch.

10. The apparatus defined in claim 9 wherein said transverse conveyor means is constructed and arranged such that said road-vehicle roadway passes over said transverse conveyor means and said carriages thereon.

11. The apparatus defined in claim 9 wherein each of said carriages is provided with a first set of four wheels oriented for travel along said transverse conveyor means and a second set of four wheels oriented for travel along said transport stretch, at least one of the wheels of each set being connected to a drive.

12. The apparatus defined in claim 11 wherein said drive comprises a single motor, two drive shafts and a transmission between said shafts.

13. The apparatus defined in claim 11 wherein said wheels ride upon respective rails of said transport stretch and said transverse conveyor means and at said transfer means one pair of rail sections is raisable to guide the carriage while another pair of rail sections is lowered out of engagement with said wheels of the carriage.

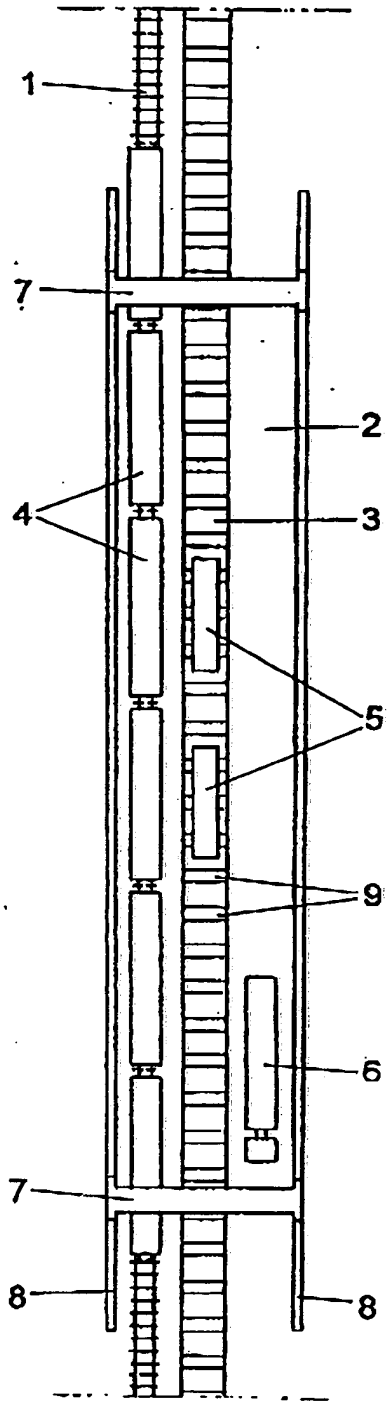


Fig. 1

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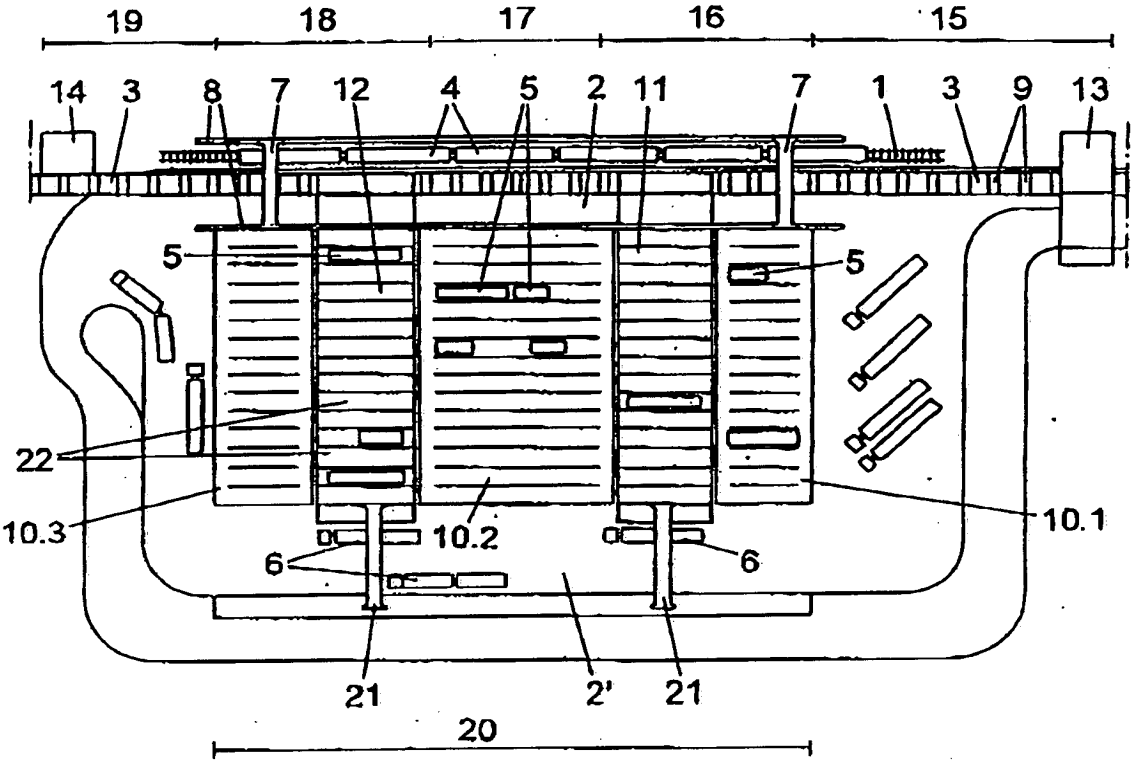


Fig. 2

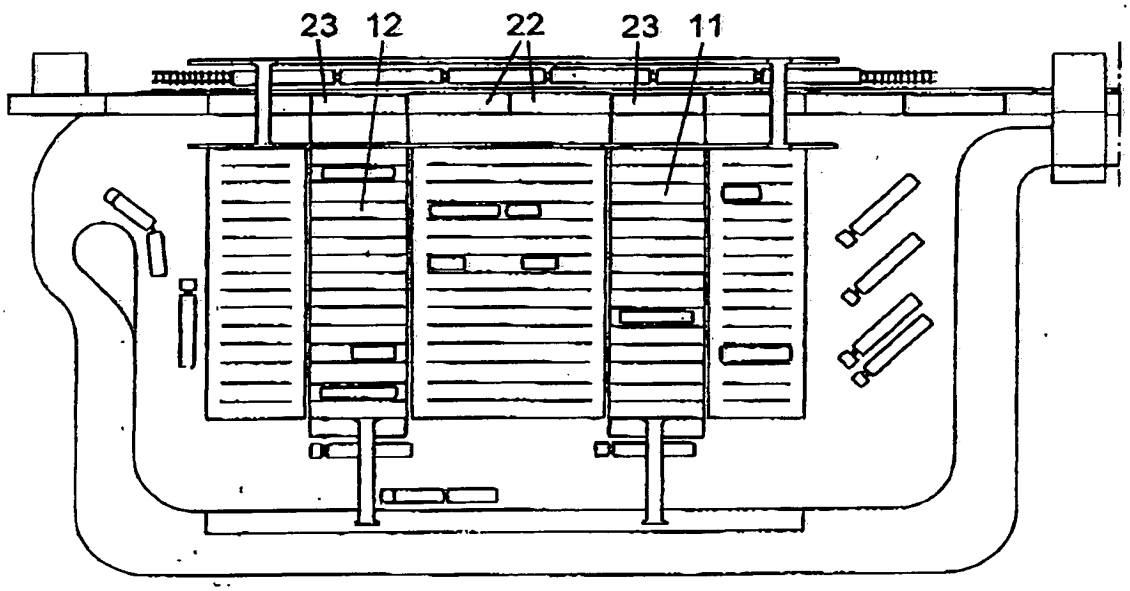


Fig. 3

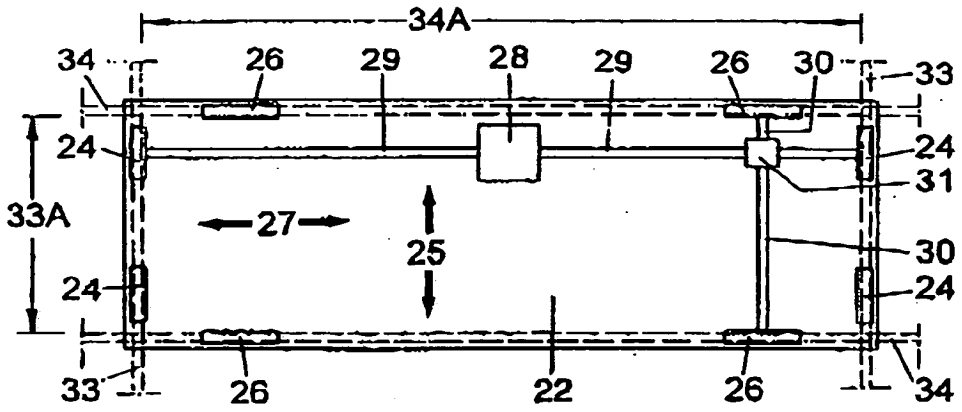


Fig. 4

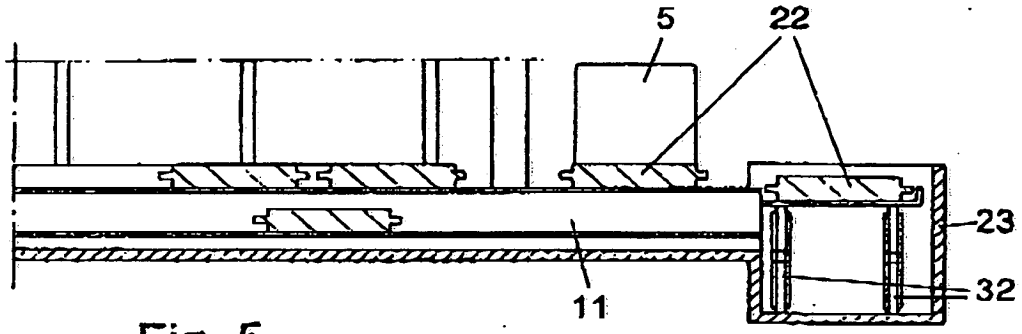


Fig. 5

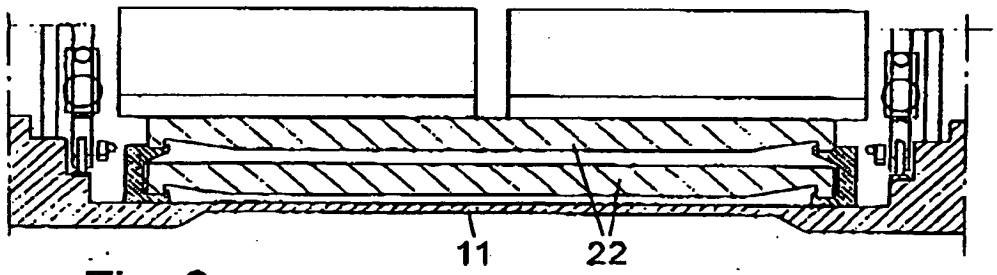


Fig. 6

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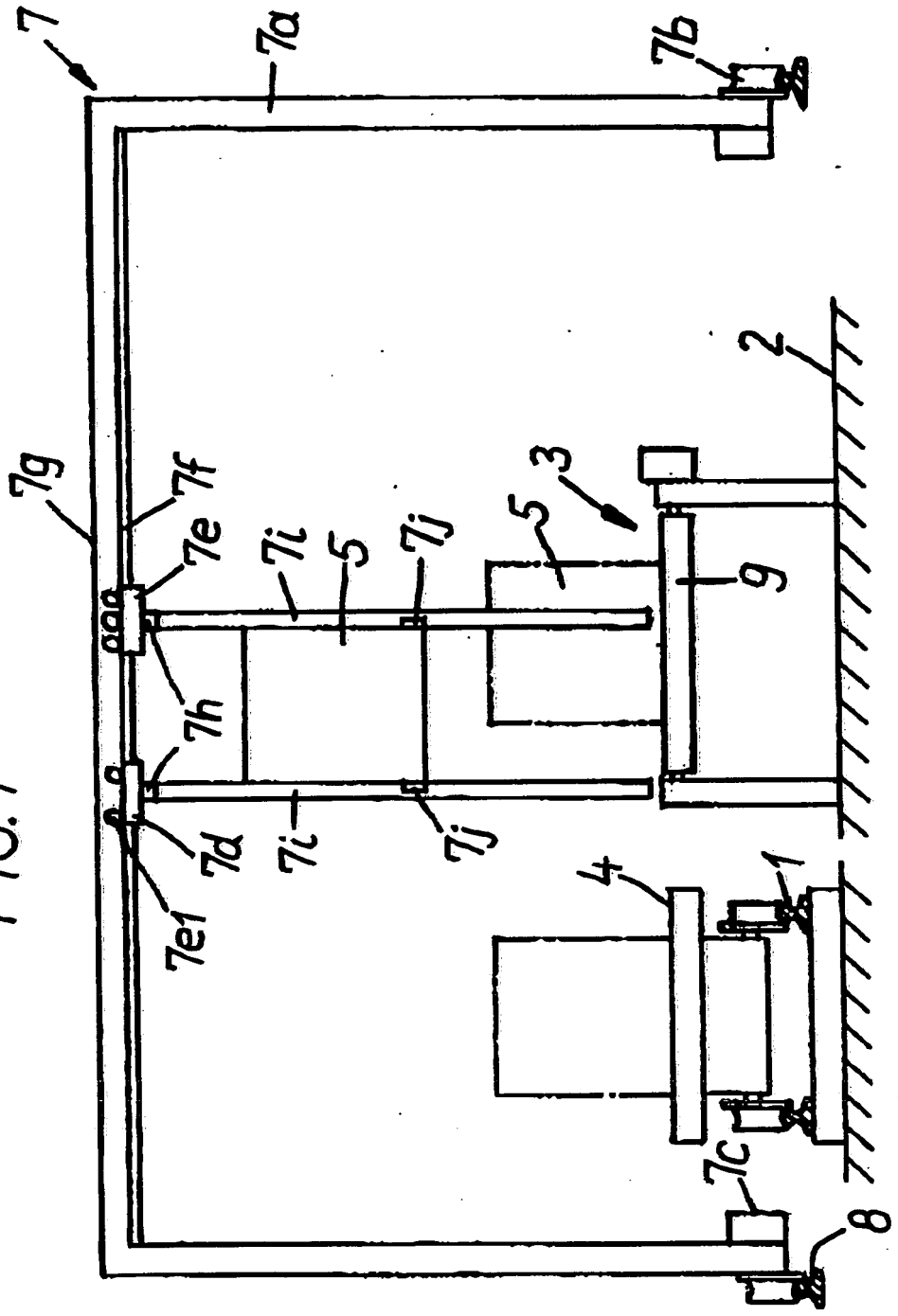


FIG.7

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